

ROMANCING THE GEMS

“Art is not what you see, but what you make others see.”

– Edgar Degas

A rural Thai gem cutter's bench, Vanutsaporn Treemok, 2020, Multicolour.com

The cut is what shows off a gemstones' sparkle and luster. There's magic in those reflections that instinctively capture our attention and mesmerize our perceptions. The flashes of colors and the contrasts between light and dark awaken wonder and captivate our senses.

The fashioning of rocks began with prehistoric people, and we see it first in the flints and arrowheads they used for hunting. The discovery of the great secret that some stones are harder than others led to the realization that weapons could be shaped and sharpened to improve their sustenance.

Over time this understanding of hardness evolved to the fabrication of ornamental stones like amber, turquoise, lapis and jade (nephrite). In the earliest stages, grinding was accomplished by rubbing one crystal face against the other. Later, it was discovered that dust from this rubbing could be collected and applied to polish other stones. When the dust was small and fine-grained enough, it could be effectively used as an abrasive to remove larger scratches. Because of their high hardness, gemstones like rubies, sapphires and diamonds could initially not be worked because there was no way to shape them.

The practice of cutting gemstones to specific configurations and developments in diamond-cutting and cleaving was established in Europe and India by circa 1380. The European cutters are generally credited with making diamond cutting an art form, striving for pleasing shapes, and improving light performance. The Indian cutter's objective was more to polish existing faces without regard to symmetry or structure. The Indian diamonds would have weighed more, but the European stones may have been more brilliant. In this regard, little has changed, and for some gemstones, the debate about cutting for weight or brilliance continues even today.

It's the lapidary's job to present the largest, cleanest gems with the best colors and proportions. Extinction and windowing are terms that have been adopted to discuss the optical properties of a cut. Extinction refers to those parts of a gemstone that reflect black, while windowing describes a see-thru effect in shallow gems. Ideally, a jewel should show little extinction or windowing, and specific angles will maximize brilliance if the transparency is sufficient.

The machinery for faceting gemstones has expanded from “jam-peg” setups where the best angles are approximated by jamming the dop stick into a fixed hole, to index machines that accurately measure the orientation and angle of every facet. Jam-peg machines are still used in Thailand, India and Brazil. They are less accurate than index machines but inexpensive and fast to use. They're also great for saving weight and re-polishing.

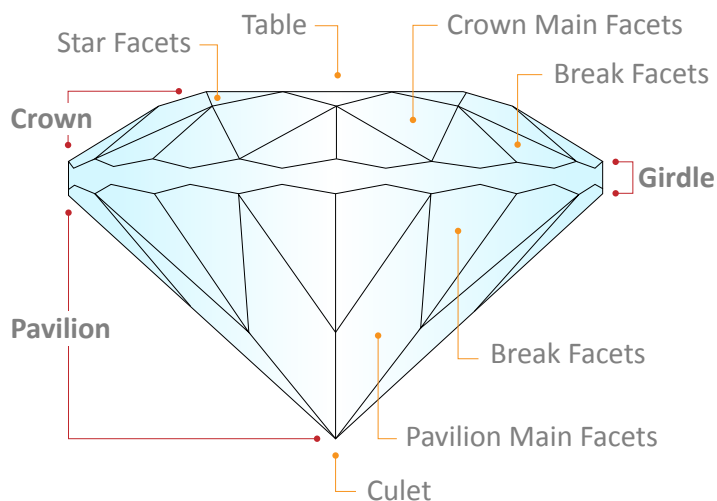
Modern faceting machines are more accurate but slower to use and adjust. They utilize indexed gears to subdivide the outline of a stone into equivalent units. The units are known as indices, and cutters can follow them to maintain perfect symmetry. The inclinations can also be measured and will maximize reflectivity when they are set at optimal angles.



This Mahenge Spinel kiss (2.41-carats) came about from finding a way to deal with inclusions in critical positions. The stone would otherwise have been a marquise with a prominent flaw. Here, the evocative lips retain both color and size while offering inspiration for creative designers.

Faceting diagrams that layout specific angles and indices are published in books and magazines and are readily available to be used or modified. While many hobbyists and professionals follow these diagrams to develop patterns, some lapidaries can achieve great results by eye alone. From the simplest, most rudimentary tools to the most complicated robotic devices, all kinds of machines have been developed to cut gemstones. Still, it's not the equipment's price but rather the skill and experience of the lapidary that will determine the quality of the cut.

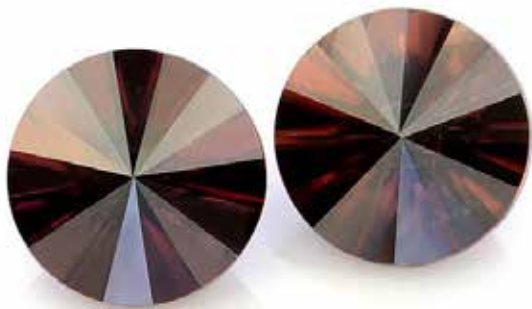
The proportions and angulations for faceting diamonds are well known, and most diamonds are cut to nearly ideal proportions with pavilion angles at 41.5 degrees. They are relatively clean, and their natural habit is perfect for cutting square or round brilliant shapes. 3-D software is available to suggest the best forms for a given piece of rough, but most diamonds are still cut individually one by one. The RBC (round brilliant cut with 57 facets) is the most famous cut of all, and millions of stones have been cut in this style... far more than any other cut.



Marcel Tolkowsky (25 December 1899 – 10 February 1991) is generally acknowledged as the father of the modern round brilliant diamond cut. An engineer by education, he was a Belgian member of a Jewish family of diamond cutters from Poland. Many of his relatives also became notable diamond cutters, including his cousin Lazare Kaplan and his great-nephew Gabi Tolkowsky.

As a part of his Ph.D. topic at the University of London, Tolkowsky systematically studied the grinding of diamonds according to mathematical calculations that considered both the brilliance and the refractive indices. He found that if a diamond were cut too deep or too shallow, the light would escape out the sides or the bottom resulting in a loss of brilliance.

Colored stones are different, they are rarely clean, and their shapes are variable. They can be blocky, rounded, angular, tabular, elongated or flat. Because of their inclusions and colors which can be patchy or pleochroic, any concerns about orientation require experience and foresight. The pavilion angles ideally range between 42 and 43 degrees for common cutting styles.



Appropriately known as the "fog cutter," the cut incorporates both a brilliant cut pavilion and a similarly faceted table... a great way to deal with flat rough or to put some fire into dark material like this pair of East African Zircons.

Faceting is an unforgiving art that requires attention to detail. Unlike painting or writing where mistakes can be covered up or edited, cutting errors will result in losses of material and value. If just one facet is overcut, the cutter might need to re-cut every facet in that row to make them the same length. It takes a light touch and a patient temperament to cut stones.

Myriad shapes are always a possibility, but the basic cutting styles are a function of the rough and the face's shapes. There are three basic facet shapes, rectangles or trapezoids, triangles and kites. Diamond cuts use a combination of triangular and kite-shaped facets, step cuts apply mostly rectangular facets, and Portuguese cuts utilize kite-shaped facets. Based on the facet contours and girdle outlines, innumerable combinations are possible, and they are continually being modified, adapted, or refined.

When cutting inexpensive raw materials like synthetics, or semi-precious stones like amethyst, citrine and topaz, yield doesn't matter much because the rough is relatively cheap. It's mostly a question of getting the sizes and the angles right. Still, careful cutting requires more time and attention. While we all want perfectly cut stones, the market is often unwilling to absorb the higher costs of better work, and many stones are cut for speed and only to "good enough" standards.

For precious and valuable stones, the higher prices allow for more scrutiny and attention to detail. Evaluation of the rough is critical and will ultimately determine the profit and saleability of the piece. Some crystals are too flat, some are heavily included, some are too dark, and some are too light. The most important job is deciding which shape and orientation will yield the largest, most attractive gem.

Flat or windowed gems are always a problem because their brilliance can only be improved with significant weight loss. We can consistently achieve better brightness with a better cut, but only at the expense of a smaller size. A good solution is the rose cut, which has been around for hundreds of years. Most sources believe it was developed in India and brought to Europe by Venetian merchants. The main advantage is its utilization to fashion flat stones, and it can provide a maximum spread and yield for a crystal's weight and size.

Rose cuts are generally round. The double rose, cut with a similar top and bottom, achieved some popularity in the 19th century and continues to be favored for unusual designs that focus on color and size. Moreover, variations of rose cuts transitioned into related cuts like briolettes, pendeloques, beads and spheres. None of these cutting styles are exceptionally brilliant compared to an RBC, but they do preserve color and size, and sometimes that's the best option.

Heavily included stones should be cut en cabochon or in checkerboard styles, and over-dark stones may look better with a window to lighten their body-color. In general, there is no single solution, and every stone can be cut several ways. Some gems are cut to fulfill orders, and some are cut on speculation. It's up to the lapidary to make the best choices.

For the ultra-rare gem materials, the final weights and sizes are critical to their valuation and the maximization of yield retains the highest values. Collectors of these stones prize the largest stones even if their cutting is imperfect. Rare and valuable gemstones don't require perfect faceting, and inconsistencies can be overlooked. For collectors, the weight gives them their bragging rights (my stone is over 10 carats, how big is yours?) A poorly cut stone can always be re-cut, but once a stone is cut and reduced in size, it can never be sized up again. There is no undo button!

*"Rough diamonds may sometimes be mistaken for worthless pebbles."
~ Thomas Browne*

The first step is to inspect the rough, and a bright fiber optic light works best. Gemstone rough is often cracked or fractured and requires knocking or slicing before shaping. There are a few ways to deal with the cracks. For large rocks, diamond saws can cut along the cracks or cut them out. Small rough can be prepared with tile clippers that apply pressure along the fracture lines to break them into cleaner pieces. Sometimes even hammers are used to break the stones along the fractures in a process known as cobbing. One way is not better than another, and the best approach depends on the size and condition of the raw material and the available tools.



This light colored amethyst is large and clean. The interior of the stone lights up and appears transparent and brilliant – it simply rings clean and bright and this is what we always hope for. The areas that may appear to be cracked are actually just the surfaces of the crystal reflecting to the lens. It may take some experience to know, but this stone is ideal for cutting and this is the quality of rough that can be faceted.

After the cracks and fissures have been dealt with, the stones need to be pre-formed. This is the most critical step, and skilled pre-formers command the highest wages. Although tools and templates for shaping exist, the best pre-formers are artists that maintain the biggest stones by eye alone.

The term “native cut” is a term used to describe poorly proportioned gemstones. Perhaps a better description would be the “first cut.” The first cut is like a rough draft, and stones can be cut approximately the first time just to get a better idea of the possibilities. Some of the very people that complain about native cuts are the hobbyist cutters and resellers who buy them precisely because they can foresee what they can achieve with an improved cut. Good cutting is the process of cutting a stone from the rough to the end product, and there can be a whole series of steps and re-cuts in that process. There is no advantage to cutting a stone correctly on the first try.

Commercial gemstones are usually cut into calibrated sizes that are easy to set up in mass-produced mountings. For more rare and valuable gems, a compromise between weight and ideal proportions is the practical solution. Some people want a large flat stone that will look big in a ring but cost less, while other customers prefer a smaller, brighter gem for the same price with perfect proportions and angles.

The quality of the finish is critical, and the best polish will produce the brightest stones. Hard stones are polished on copper, tin, tin-lead, ceramic, zinc, cast iron, or hard resin bond laps. Harder polishing laps offer the most potential for flat facets, but lapidaries have their own preferences. Although ultra-hard cast iron laps used for diamonds can provide a supreme polish on even softer gemstones, they are more challenging to use. Resin bond laps work well with emeralds and other heat-sensitive stones because they can be water-cooled. The lower heat reduces the chances of fracturing these sensitive stones.

The best polishing compounds employ diamond powders in very small sizes down to 1/2 micron in diameter. The diamond dust is mixed with a waxy

or oily carrier to adhere to and spread it upon the lap. Olive oil works well, but it should not contain any water. Water causes the diamond to coagulate and scratch the stones. Synthetic and natural diamonds can be used to polish, and both are effective. Synthetic diamonds are more popular because of their lower prices, but natural diamonds are sharper with more friable edges that polish faster.

Nowadays, tiny stones are cut by robotic systems where machines can cut up to over 100 stones at once. Typically, one station will be for faceting and another for polishing. These systems are usually used for stones of less than 3mm and down to sizes below 1mm for watch manufacturers. When we think about a polishing environment with diamond dust and water, it's easy to imagine the wear of metal components which are like butter to diamond abrasive. These machines are inordinately expensive to develop, and the parts require continuous maintenance to sustain precision. Imagine polishing 100 stones together at the same time. Every stone cannot come out perfectly, and some will always be rejected.

THE STATE OF THE INDUSTRY

Like the famous gem cutters from Idar-Oberstein from the last century, traditional gem cutters from Korea, China, Thailand, India and Sri Lanka are also moving to other occupations.

Gemstone cutting is tedious and tiring and doesn't pay enough. Commercial manufacturers cannot increase wages because the general public is unwilling or unable to pay more. Lapidary workers will continue to move to more comfortable occupations like retail or construction that pay the same but require less concentration and allow for socializing on the job.

The future of gem cutting is uncertain. There's always enough room to pay fair salaries for the top stones, but for lesser qualities, wages are insufficient and there always seems to be a shortage of workers.

ART OF THE CUT

In faceted stones, specific indices and critical angles enhance brilliance and reflectivity but nature produces rough stones in a wide variety of shapes and sizes. The cutter's job is to maximize the yield and produce the largest stone from whatever is available.

MOST ARTISTIC BLEND

A fusion of cutting and carving, the channels and knobs add texture and color to a crystal that may otherwise have been too cloudy to facet. Drops like these are typically drilled to be dangled as earrings or pendants.



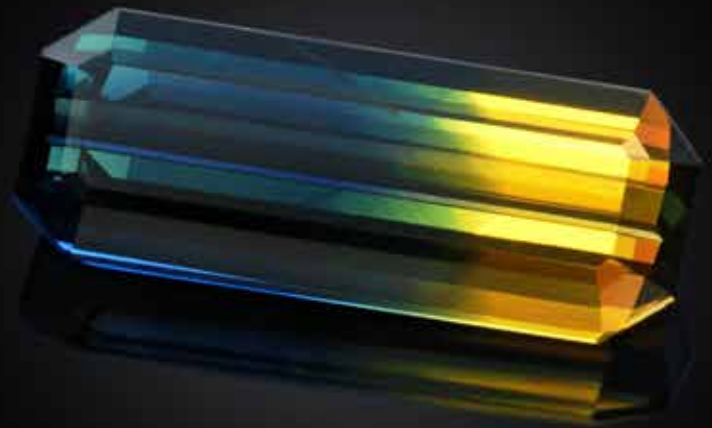
MOST CREATIVE DEUCE

One of the only options to retain the size and color of this Chrome Tourmaline from East Africa, was to fashion an amazing rondelle weighing 20.06-carat and measuring over 20mm in diameter. The stone began its life as an exceptionally large, but flat piece of rough yet the cutter was still able to facet it into a modified rose cut.



MOST EXOTIC PICTURESQUE

The conventional approach would have been to facet a yellow or a blue stone, but the lapidary took advantage of the parti-coloring and highlighted both. The 4.65-carats bi-colored sapphire is from Garbatulla in Northern Kenya.



MOST POPULAR BRAG

Due to the diamond's unique optical properties, some of the fancy shapes can be cut shallow with little loss of brilliance or scintillation. As a result, the face up sizes are larger and the stones may appear more impressive than conventionally cut round brilliants.



MOST INTRICATE ARTISAN

Unlike flat facet cuts, the concave cut is contoured with curves that create the impression of grooves. Special tooling is required to produce this style but the eye catching optics make a big difference.



RELICS & RARITIES

Diaspore is mainly known to occur in the Mugla Province of Turkey. This material is usually near colorless or brownish green in daylight changing to lavender or pinkish yellow under incandescent light. It is alternatively sold under the name of Zultanite, which is a trade name introduced by Murat Akgun, the primary owner of that deposit. "Ottomanite", and "Csarite" are additional names trademarked for color changing diaspore.

Purplish stones were known to occur occasionally in Turkey, Myanmar, and the Ural mountains of Russia but in mid March 2020, purple stones from an apparently new source were presented by an Afghani dealer. According to seller, the source of the stones is in Kama Goshta, near Jalabad.

Most of the stones are small and difficult to cut because of the easy cleavage, but a few stones of over 20 carats have also been retrieved. None of the small stones appear to show any color change, but large stones may show a subtle color shift.



Vanutsaporn Treemok, 2019, Diaspore, Multicolour.com

PROSPECTOR'S CORNER

Tanzanite is the name for the transparent blue to violet-blue variety of the mineral Zoisite. Nearly all of the blue Tanzanites on the market owe their color to heat treatment. Heating is what reveals Tanzanite's attractive pleochroic blue and violet hues. Untreated Zoisite (Tanzanite) usually forms as a reddish-brown crystal. Amazingly, the darkest brownest stones heat to the most vivid intensive blues. In rare cases Zoisite is also found to be pink or green and these colors don't require any treatment.

Upon heating between to 350°C, the Vanadium ions oxidize the brownish components to deep purple or blue. Unlike sapphires where the heating is nowadays unpopular, the heat treatment of tanzanite is widely accepted and expected.



Vanutsaporn Treemok, 2018, Well-defined crystal on graphite matrix, Multicolour.com

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